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Before the
Federal Communications Commission
Washington, D.C. 20554

JUN 19 1996

In the Matter of	)	
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Amendment of Parts 2 and 15 of the Commission's Rules Regarding Spread Spectrum Transmitters	)))	ET Docket No. 96-8 RM-8435, RM-8608, RM-8609

Comments of Master Lock Company

Master Lock Company, maker of Master Lock® products, hereby submits its comments in response to the Commission's *Notice of Proposed Rule Making ("Notice")*, 11 FCC Rcd 3068 (1996), in this proceeding. For the reasons set forth herein, Master Lock urges the Commission to clarify the rules and policies applicable to "short hop" spread spectrum systems.

I. Identity and Interest

Master Lock designs and manufactures America's leading line of padlocks and security hardware. Its distinctive padlocks and other locks protect life and property throughout the country. As a leader in lock and key technology, Master Lock looks to the future in which electronic security systems will assume an ever greater role. Spread spectrum technology will play a central part in facilitating secure electronic access control. Many of these applications can be enhanced by the use of so-called "short-hop" spread spectrum systems.[1] Short hop systems can be expected to be found in various remote control applications including those in which

[1] A "short hop" system can transmit all or most of the information within a single transmission involving only one pseudorandomly selected frequency. Thus, a short hop system may not need to cycle through all of the minimum number of hopping frequencies in order to accomplish the desired communications. Notice ¶ 39.

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locks may need to be actuated. Accordingly, Master Lock is particularly interested in the issues raised in Paragraphs 39 and 40 of the *Notice*.

II. Short hop systems should be capable of functioning as a conventional frequency hopping system when presented with a data stream that is longer than could be transmitted within the time allowed for a single hop.

Confusion has arisen as to how short hop systems should be treated under Section 15.247 of the Commission's Rules. The current rules permit a hopping channel to be occupied for up to a maximum of 400 ms within 20 seconds. Many communications needs, however, can be met within the time that a system is permitted to dwell on a single channel. While the data transmitted within this short time may be very limited, the message could be of the utmost importance. For example, such a signal could include information necessary to unlock a door, report a fire, or alert authorities to a possible crime or medical emergency. In short, the length of the data stream may be very short, but the message conveyed could be a matter of the greatest urgency. Such transmissions should be carried out in efficient and reliable fashion.

Currently, the Commission requires that short hop systems function as a regular frequency hopping system if presented with a data stream too long to be transmitted within a single hop. *Notice* ¶ 40. This interpretation of the rules has evolved over the last year.[2] It allows

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[2] Master Lock understands that prior to the current interpretation, the Commission was unwilling to authorize systems under Section 15.247 that might not need to employ all 50 channels within a hop set to accomplish the desired communications. Such an interpretation created rather perverse incentives as designers of systems that could, if necessary, use all 50 channels within a single exchange of information but did not have to do so were forced either (1) to proceed under other rules that effectively limited the operating range, or (2) to redesign their systems so as to transmit information redundantly or to compromise reliability by breaking the message into unnecessarily short segments in order to utilize at least 50 hopping channels with far less than 400 ms on the air time per channel. While the latter would at least appear to

short hop systems to be authorized under Section 15.247, provided that the equipment authorization grantee can show that the system would transmit on frequencies to be selected on a pseudorandom basis if confronted with a data stream longer than the duration of a single hop. Master Lock supports this interpretation and urges the Commission to incorporate such a view into the *Report and Order* in this proceeding.

If a system were not to hop among pseudorandomly selected transmitting channels for each transmission, its use could conceivably preclude another device from operating nearby as the non-hopping system effectively jammed the channel on which it operates. Operation on a non-pseudorandomly chosen set of channels would likely produce an environment in which a multitude of disparate Part 15 devices were less compatible due to the preclusive effect such a system would have on other devices intent upon using the same spectrum. The effect would be particularly detrimental to non-spread spectrum devices, which are limited to significantly less power under the Commission's Rules. For this reason, systems that cannot meet the requirements of Section 15.247 are accommodated under other FCC regulations.[3]

Additionally, the rules currently stipulate that a frequency hopping spread spectrum system must have a receiver that tunes to the transmitter frequencies and has a bandwidth that approximates that of the transmitted signal. 47 C.F.R. § 15.247(a)(1) (1995). In this manner, the Commission prevents the advent of systems that are called "frequency hoppers" but which do

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reduce the chances for interference, the irony is that the system would face interference and competition from other systems that occupied a given channel for the full 400 ms before hopping to another channel within a hop set -- hardly a fair or reasonable result.

[3] As the Commission points out, such operations sometimes can be conducted satisfactorily under Sections 15.231(e) or 15.249 of the Rules. Notice ¶ 41.

not, in fact, exhibit the interference mitigation techniques that characterize systems contemplated in the development of the spread spectrum regulations designed to foster innovative, yet largely compatible, technologies for unlicensed operations.[4]

Well-designed short hop systems can meet both the letter and the spirit of Section 15.247 by functioning as a conventional frequency hopping spread spectrum system when presented with a data stream or communications task that takes longer than the duration of one hop. As with any frequency hopping system, however, short hop systems must first synchronize the receiver's frequency hopping with the transmitter's hopping.

A variety of approaches should be accepted in considering the need for frequency hopping systems to achieve the needed synchronization. From a spectrum management standpoint, however, any scheme for synchronization of the transmitter and receiver should minimize the time on the air solely for the purpose of achieving synchronization, lest the time necessary to accomplish synchronization take significantly longer than the time needed to transmit the message. Thus, in some cases the system might be designed to include within the main transmission information alerting the receiver as to the next frequency to which it should

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[4] The requirement for the receiver bandwidth of frequency hopping spread spectrum systems to match that of the transmitted signal is more in the nature of a quality criterion than a rule that directly reduces the potential for interference. Such a regulation has the indirect effect of reducing the interference complaints from *users* of the system in which the receiver is incorporated. It may also encourage designers to employ less transmitted power so that it will not be necessary to overcome a larger amount of noise entering the receiver. The rule further could have the indirect effect of discouraging the proliferation of relatively high powered transmitters that would be marketed only if a very cheap receiver were permissible. The direct interference potential of a particular system is more dependent on the field strength of its radiated signal and the sensitivity and selectivity of the victim receiver. As such, whether the public interest would be served better by eliminating the receiver bandwidth constraints thereby facilitating lower cost equipment is a moot point subject to reasonable differences of opinion.

tune. The frequency, however, should be selected on a pseudorandom basis from among the channels available. Even in such systems, however, the transmitter must operate initially without being synchronized with the receiver as the transmitter and receiver work to attain synch.

Other schemes could require that synchronization be achieved anew each time a transmission is made. Theoretically, such an approach could lead to far more "air time" and greater interference potential than otherwise would be needed to transmit the data if the system operated inefficiently. For example, the message might occupy 200 ms of air time, but a much greater amount of time (*e.g.* up to 50 times the time needed to transmit the message) could be employed to synchronize the transmitter and the receiver. Accordingly, such a system could very well devote most of its transmissions to establishing synch with the receiver. Fortunately, there are operational requirements that would mitigate against such an approach in most applications. For example, the applications for short hop systems would likely be constrained by the battery power limitations of a hand held transmitter.[5] In short, it simply is not in the system proponent's interest to spend far more air time getting the transmitter and receiver in synch than in communicating the message.

Even in those cases in which battery power would not be a major concern (*e.g.* the transmitter is powered from the AC mains or an automobile electrical system), there would still be a premium on minimizing the time required for synchronization because taking upwards of 20 seconds to transmit a 400 ms message would often be perceived as an unacceptable wait. Thus, there is no need to mandate a fixed ratio of synchronization time vs. message transmission time.

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[5] Similarly, stand-alone transmitters with long-life batteries would need to be designed to minimize power consumption.

Competition will foster the development of efficient designs. The rules should, however, recognize that the system must select, on a pseudorandom basis, from among the hop set channels each frequency on which a transmission is to be made. This could be accomplished by having the pseudorandom number generator in the transmitter continue to run even when the transmitter is not on the air. Alternatively, a set of channels to be used for the next specified number of transmissions could be chosen on a pseudorandom basis at various times through the day in advance of the transmissions and the list transmitted from transmitter to receiver initially to set up the next transmissions, which would occur as the need arose. In any of these examples, the near term selection of a frequency would appear to be random, the long term use of the channels within the hop set would appear to be distributed evenly throughout the hop set, and sequential hops would be randomly distributed in both direction and magnitude of change in the hop set.[6] To support the important policy goal of advancing the development of technology, the rules should be interpreted to accord a high measure of flexibility as developers work to achieve designs that meet operational requirements.

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[6] To the extent that a system might have a total dwell time on a given channel of, for example, 100 ms as the system is attempting to establish sync and 400 ms to transmit the desired data once the receiver and transmitter are hopping to the same channels at the same time, such arrangements should be permitted since a shorter time on a given channel during the synchronization lock up stage will mean that there is less potential for interference on those channels on which transmissions take place solely in an effort to establish synchronization.

Conclusion

Short hop spread spectrum systems should be encouraged. It stands to reason that low duty cycle brief transmissions have less potential to cause interference than comparably powered longer duty cycle operations that cannot accomplish routine communications in less than the time permitted for a transmitter to dwell on a single channel. At the same time, short hop systems should be required to hop so that there is a high probability that each transmission will occur on a pseudorandomly selected different channel from that which was employed for the previous transmission.

Respectfully,

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